

OHIO ENVIRONMENTAL PROTECTION AGENCY (OHIO EPA)  
DIVISION OF EMERGENCY & REMEDIAL RESPONSE (DERR)

SUPPLEMENTAL EXPANDED SITE INVESTIGATION REPORT


OLD DELAWARE CITY LANDFILL  
Delaware County, Ohio

EPA Region 5 Records Ctr.

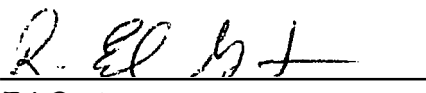
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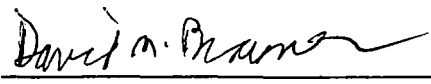
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# Non-Responsive

# Non-Responsive

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**Division of Emergency and Remedial Response**

# **Old Delaware City Landfill Supplemental Expanded Site Investigation**

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**January 2008**

Governor Ted Strickland  
Director Chris Korleski



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## EXECUTIVE SUMMARY

The Ohio Environmental Protection Agency (Ohio EPA) Division of Emergency and Remedial Response (DERR) under a cooperative agreement with the United States Environmental Protection Agency (U.S. EPA) conducted a supplemental expanded site investigation (SESI) of the Old Delaware City Landfill (site) in the city of Delaware, Delaware County, Ohio.

The purpose of this SESI is to determine if hazardous substances from previous waste disposal activities at the Old Delaware City Landfill are migrating off-site, and if so, whether these substances pose a potential threat to human health and the environment. Data that were collected will be used to demonstrate whether or not the site is of National Priority List (NPL) caliber by documenting observed releases, observed contamination and potential targets.

The site is a former municipal solid waste landfill that operated from approximately 1951 to 1975 and is bordered on the east and south by the Olentangy River, a state scenic river. The landfill is unlined and does not have an engineered cap or leachate collection system. The site has a documented history of leachate outbreaks to the Olentangy River.

As part of the SESI, surface water, sediment and leachate samples were collected from the site on July 10, 2007. An additional sample was collected from a seepage area on September 19, 2007. The sampling methods, results and discussion are presented in this report.

In addition to the SESI, Ohio EPA recently completed a state site assessment of the landfill, which included a field investigation conducted during December 2006 in which soil, ground water and leachate samples were collected and submitted for laboratory analysis. An additional ground water sample was also collected on September 19, 2007. The results and conclusions of the state site assessment are included in Ohio EPA's *Old Delaware City Landfill Site Assessment Report* dated January 2, 2008 and are also discussed in the SESI report for a more complete understanding of the site.

Sample results from the SESI did not indicate impacts of surface water quality in the Olentangy River relative to upstream background samples at the time of sampling. Sediment sample results, however, did yield elevated detections of several polynuclear aromatic hydrocarbon (PAH) compounds and polychlorinated biphenyls (PCBs) relative to background.

A surface water sample that was collected from the outfall of a storm sewer, which passes under the landfill and discharges to the Olentangy River, contained significant detections of metals including barium and mercury as well as elevated detections of general water quality and nutrient parameters including ammonia, total Kjeldahl nitrogen (TKN), chemical oxygen demand (COD) and chlorides.

Samples were also collected from a river bank seep and a ditch near the toe of the landfill slope to determine the presence of leachate. These samples contained significant detections of metals. The ditch sample also contained a significant detection of cyanide. Both samples contained elevated detections of general water quality and nutrient parameters.

Results of the state site assessment field investigation conducted in December 2006 indicated the presence of ground water contamination at the site. Shallow ground water grab samples collected with Ohio EPA's Geoprobe® drilling rig yielded detections of several volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, PCBs and pesticides above U.S. EPA maximum contaminant levels in shallow ground water at the site. Shallow ground water flow at the site is presumed to discharge to the Olentangy River.

Results of the SESI and previous state site assessment indicate leachate discharge to the Olentangy River from the landfill, in the form of direct seepage through outbreaks, infiltration into storm sewer lines and contamination of shallow ground water, is occurring.

## 1.0 INTRODUCTION

The Ohio EPA DERR entered into a cooperative agreement with U.S. EPA Region 5 to conduct an SESI of the former Old Delaware City Landfill, U.S. EPA ID # OHD980510366 (Latitude: 40° 17' 25"N, Longitude: 83° 03' 30"W).

The landfill is located along the west bank of the Olentangy River east of U.S. Route 23 and north of Olentangy Avenue on city-owned property. The city's municipal wastewater treatment plant, maintenance garage, salt sheds and recycling center are also located on the site.

The landfill was operated as a municipal solid waste landfill by the city of Delaware from approximately 1951 to 1975 and received municipal, commercial and industrial wastes. The landfill was closed prior to Ohio EPA's 1976 solid waste rules with no liner or engineered cap system in place. The landfill has had a documented history of leachate outbreaks to the Olentangy River and has been inspected or investigated by the Ohio Department of Health (ODH), Delaware County Health Department, Ohio EPA and U.S. EPA as summarized in Section 2.6 - Previous Site Investigations.

The work plan for this SESI was approved by U.S. EPA on June 26, 2007. Field investigation activities for the SESI consisted of the collection of surface water and sediment samples from the Olentangy River along with a seep sample and storm sewer outfall sample on July 10, 2007. An additional leachate sample was collected on September 19, 2007. The results of the SESI field investigation are included in this report.

Soil, ground water, and leachate samples were also recently collected as part of an Ohio EPA state site assessment of the site on December 5-6, 2006 and September 19, 2007. The results and discussion of the state site assessment sampling are included in Ohio EPA's *Old Delaware City Landfill State Site Assessment Report* dated January 2, 2008. Excerpts from the state site assessment and a discussion of the soil and ground water results are included in this SESI report.



## 2.0 BACKGROUND

**Site Name:** Old Delaware City Landfill

**Alias:** Cherry Street Landfill

**DERR I.D. No.:** 121-000606-006

**U.S. EPA I.D. No.:** OHD980510366

**District:** Central District

**County:** Delaware

**Site Address:** 241 Cherry Street, Delaware, Ohio 43015

### Directions to Site:

From Central District Office: North on State Route 315 to Interstate 270 (I-270). Take I-270 east to U.S. Route 23 North. Continue on U.S. Route 23 North to Stratford Road. Follow Stratford Road north approximately 2 miles. Stratford Road becomes Cherry Street north of the Olentangy Street intersection. Continue north on Cherry Street to the wastewater treatment plant. The landfill is on city-owned property on the east side of Cherry Street and south of the municipal wastewater treatment plant.

**Latitude:** 40° 17' 25"N

**Longitude:** 83° 03' 30"

## 2.1 Maps Attached

Figure 1: Site Location Map; Figure 2: Site Features Map; Figure 3: Sample Location Map.

## 2.2 Site Description

The Old Delaware City Landfill, also known as the Cherry Street Landfill, is located on property owned by the city of Delaware north of Olentangy Street between U.S. Route 23 and the Olentangy River. The site location is displayed on **Figure 1**. In addition to the landfill, the city-owned property is occupied by the municipal wastewater treatment plant, maintenance garage, salt sheds and recycling center. The footprint of the original landfill has changed due to periodic waste removal and relocations to allow for expansion of the wastewater treatment plant. The area of waste placement was determined to be approximately 33.4 acres according to a waste delineation survey conducted in 2000 (Malcolm Pirnie). The most recent waste relocation occurred in 2003. The site features are displayed on **Figure 2**.

## 2.3 Regulatory Information

The landfill is currently regulated by the Ohio EPA Division of Solid and Infectious Waste Management (DSIWM) for explosive gas migration monitoring only. DSIWM does not otherwise regulate the landfill although DSIWM has reviewed applications for periodic waste relocations under Ohio Administrative Code (OAC) Rule 3745-27-13.

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The Olentangy River, which forms the western and southern boundary of the site, is a state designated scenic river. The river is classified by Ohio EPA as a warm water habitat.

The Olentangy River is currently under a Waterbody Specific Advisory, issued by the Ohio EPA, Division of Surface Water (DSW), from State Route 95 at Claridon downstream to its confluence with the Scioto River at Columbus. This includes the portion of the river that borders the site. The advisory recommends limiting the consumption of one smallmouth bass per month 12" and over. The specific contaminant of concern is mercury. The advisory is not specific to the site.

Due to the advisory U.S. EPA requested that the field sampling team observe if people were fishing at the time of the sampling event and request that people fishing sign a voluntary statement as to whether they were planning to eat the fish they caught. No fishing activities were observed during the SESI sampling event, however, there was evidence that people had been fishing in the past (the presence of old fishing line, etc.).

## 2.4 Site History

The landfill was operated by the city of Delaware as a municipal solid waste landfill from 1951 to 1975 and accepted municipal, commercial and industrial wastes. The landfill was licensed by the Delaware County Health Department from 1969 to 1974. The landfill was closed prior to enactment of Ohio EPA's 1976 solid waste rules. Beginning in the late 1970s, solid waste has been periodically removed from the north end of the landfill under OAC 3745-27-13 authorization and reconsolidated within the landfill area to the south to allow for expansion of the wastewater treatment plant. The approximate limits of waste placement as depicted in a site figure from the landfill's January 2008 bi-monthly explosive gas monitoring report are included on **Figure 3**. (Burgess & Niple 2008)

The landfill has a documented history of leachate outbreaks to the Olentangy River. The Delaware County Health Department, ODH, Ohio EPA and U.S. EPA subcontractors have visited or conducted site investigations at the site as summarized in Section 2.6 - Previous Site Investigations.

## 2.5 Redevelopment Activities

Several municipal operations are located on or near the former landfill footprint. The city of Delaware's municipal wastewater treatment plant is located north of and adjacent to the landfill. A new regional sanitary trunk sewer was recently installed along Cherry Street to connect to the wastewater treatment plant. The city maintenance garage and salt sheds are located immediately south of the wastewater treatment plant. The city recycling center is located on the southern end of the landfill. As stated above, periodic



expansions of the wastewater treatment facilities have required the removal and relocation of waste to the south under OAC 3745-27-13 authorization.

## **2.6 Previous Site Investigations**

Ohio EPA files indicate that ODH inspected the landfill on February 16 and 18, 1965 and August 27, 1969. The 1965 inspection documented no compliance issues; however, the 1969 inspection documented several violations and recommended construction of a dike to prevent leachate from entering the Olentangy River. In 1973, Ohio EPA and the Delaware County Health Department inspected the site and documented that many of the 1969 violations had not been corrected. Ohio EPA recommended that the city of Delaware submit plans for controlling the leachate discharges. (PRC, 1994)

Ohio EPA and ODH collected leachate samples for limited parameters including some metals and general water quality parameters in 1973 and 1974. Ohio EPA inspected the site again on April 2, 1976 and April 29, 1977. The 1977 inspection noted a "considerable degree" of leachate flowing from the landfill to the Olentangy River. (PRC, 1994)

Ohio EPA completed a U.S. EPA Potential Hazardous Waste Site Identification and Preliminary Assessment form for the site in January 1980. The form notes that sludge, oily wastes, glue and paints were disposed of at the landfill. The form also notes that leachate problems existed.

The Ohio EPA conducted a U.S. EPA Preliminary Assessment (PA) of the landfill in February 1987. The PA noted that operation records for the closed landfill indicated improper daily and final cover had been a reoccurring problem as well as a 30 to 40 feet long leachate outbreak on the south side of the landfill. The 1987 PA gave the site a high priority rating.

A Screening Site Inspection was conducted in August 1988 (report issued March 1989) by Ecology and Environment under contract with U.S. EPA as a Field Inspection Team. Soil, river sediment and leachate sediment samples were collected at the site. Residential well samples were collected from three residences within one-half mile of the site including one residence to the northeast and two residences to the south of the site. All three residences are located in upland areas on the opposite side of the Olentangy River from the landfill. The samples were analyzed for target analyte list/target compound list (TAL/TCL) parameters including VOCs, SVOCs, PCBs, pesticides, metals and cyanide. Soil and sediment samples yielded detections of VOCs, SVOCs, PCBs, pesticides and metals.

Analytes that were detected in the 1988 residential well samples that have also been detected at the site including in ground water grab samples at the landfill during Ohio EPA's 2006 state site assessment included acetone, bis(2-ethylhexyl) phthalate (BEHP) and several TAL metals.

Acetone was detected in two of the residential well samples. However, acetone is a common laboratory contaminant and the residential well detections were an order of magnitude higher than the on-site grab samples. Two residential well samples had detections of BEHP. This compound, however, was also detected in the field blank at a similar concentration to the residential well samples and is also a common laboratory contaminant. Several metals were also detected in the residential well samples but may be naturally occurring.

However, because of the location of the three residential wells relative to the landfill and relative lack of detections except for common laboratory contaminants and metals, the residential well samples appear to be unimpacted by the landfill.

An explosive gas migration monitoring plan was approved by Ohio EPA's former Division of Solid and Hazardous Waste Management in 1991. A network of 16 explosive gas monitoring wells was completed along Cherry Street and near the wastewater treatment plant and recycling center buildings by 1997. Buildings within 200 feet of the landfill were also equipped with explosive gas alarms. Several of the gas monitoring wells along Cherry Street were replaced in 2005 following construction of a new sanitary trunk sewer. Methane has been detected in several of the gas monitoring wells. Additional temporary monitoring points were installed in 2007 following an increasing trend of methane concentrations in several gas monitoring wells along Cherry Street.

Ohio EPA DERR CDO conducted a site visit in June 1992 to observe conditions and noted the presence of leachate seepage. Ohio EPA DERR CDO collected soil and sediment samples at the landfill during May 1993 and included the sampling data in a revised PA in September 1993. Five soil/sediment samples were collected including two soil samples from the Olentangy River floodplain, one sediment sample from a leachate seep, one background soil sample and one duplicate leachate sediment sample. All five samples were analyzed for TAL/TCL parameters. The soil and sediment samples yielded detections of VOCs, SVOCs, PCBs, pesticides and metals. The 1993 PA revised the site priority to medium.

An Expanded Site Inspection (ESI) was conducted in 1994 (report issued September 1994) by PRC Environmental Management, Inc. for U.S. EPA in which four soil samples, eight sediment samples and nine surface water samples were collected and analyzed for TAL/TCL parameters. The soil and sediment samples yielded detections of VOCs, SVOCs, PCBs, pesticides and metals. The surface water samples, collected from the Olentangy River at locations upstream and downstream of the landfill, yielded no detections above background except for magnesium and sodium.

In January 2000, ODH published a Health Consultation Report (HCR) under a cooperative agreement with the U.S. Agency for Toxic Substances and Disease Registry at the request of U.S. EPA Region 5, which summarized the site history and provided conclusions and recommendations for the site. The HCR concluded that the landfill was currently a health hazard based on the potential physical hazards associated with methane and recommended installing a methane gas abatement

system, sampling the landfill gas for VOCs and resampling leachate seeps discharging to the river.

In March 2000, a waste delineation survey was conducted for the city of Delaware by Malcolm Pirnie to determine the limits and volume of waste placement at the landfill. The report, issued in April 2000, determined that, at that time, there was approximately 772,000 cubic yards of waste occupying approximately 33.4 acres. During the waste delineation survey, grab samples of ground water/leachate were collected from two borings placed in the landfill. The samples yielded detections of VOCs, SVOCs, metals and nutrient analytes (Malcolm Pirnie).

During a May 2006 site visit, orange-stained water was observed discharging from a 24-inch diameter storm sewer outfall to the Olentangy River at the south end of the landfill. It was determined that the storm sewer passes through or under the landfill. Ohio EPA DSW CDO sampled the outfall in May 2006 and detected VOCs, pesticides, and nutrients including elevated ammonia, TKN and COD in the discharge indicating leachate infiltration to the storm sewer. Elevated concentrations of chlorides were also detected and may be attributable to salt and brine handling practices at the city garage salt operations in addition to leachate from the landfill. Based on the sample results, DSW issued a notice of violation (NOV) to the city of Delaware in August 2006 for discharge of pollutants to waters of the state without a National Pollutant Discharge Elimination System (NPDES) permit.

On December 4-6, 2006, Ohio EPA DERR CDO and Site Investigation Field Unit personnel conducted a field investigation as part of a state site assessment in which site soil, ground water and leachate samples were collected. The soil and ground water samples were collected from five Geoprobe® borings placed on the east side of the landfill in close proximity to the Olentangy River. An additional upgradient ground water sample was also collected on September 19, 2007. The results of the investigation indicated the presence of soil and ground water contamination at the site. Soil samples yielded detections of vinyl chloride, benzo (b) fluoranthene, PCBs, heptachlor epoxide and several metals above preliminary screening levels. Ground water samples contained detections of benzene, vinyl chloride, BEHP, PCBs and dissolved (filtered) arsenic above U.S. EPA primary maximum contaminant levels (MCLs) for drinking water. Additional total (unfiltered) metals were also detected above their respective MCLs. The results of the field investigation are included in Ohio EPA's *Old Delaware City Landfill Site Assessment Report* dated January 2008.

## **2.7 Topography, Geology, Hydrogeology and Hydrology**

The Old Delaware City Landfill is located in the city of Delaware in central Delaware County in the Till Plains Section of the Central Lowland Physiographic Province (Brockman). The site is located on an inside bend of the Olentangy River and is bounded by the river on the east and south. The edge of the landfill is generally less than 100 feet from the river and less than 20 feet from the river in some areas. Much of the site is also within the 100-year regulatory floodplain of the Olentangy River.

The unconsolidated surficial deposits in the vicinity of the site are mapped as Late Wisconsinan ground moraine with outwash terrace deposits along the Olentangy River (ODNR). The site is located near the contact of the Devonian Age Olentangy Shale and the underlying Delaware Limestone. The Olentangy Shale is overlain by the Ohio Shale, which is visible outcropping on a high bluff on the east side of the river. Limestone bedrock is exposed in the bed of the Olentangy River.

According to the U.S. Department of Agriculture Soil Conservation Service *Soil Bulletin for Delaware County, Ohio*, the soils at the site are mapped as Made Land; a soil classification for disturbed lands. Soils immediately to the west of the site, however, are mapped as Westland Silty Clay Loam indicating that this soil type may have been the original soil type at the site before landfilling activities occurred.

Geotechnical borings were conducted at the site in 1982 prior to an expansion of the wastewater treatment plant. The borings were completed to the top of fragmented or competent bedrock with bedrock cores being collected in several of the borings. The borings encountered bedrock at approximately 11 to 17 feet below ground surface (bgs). Several feet of sand and gravel were encountered immediately overlying bedrock in the 1982 borings. The bedrock was described as the Olentangy Shale and the underlying Delaware Limestone (Mason, Sandover and deVertiull, 1982).

Six replacement explosive gas monitoring wells were installed along Cherry Street in 2005 following installation of a new sanitary trunk sewer. The borings encountered up to six feet of silty clay overlying silty fine to coarse sand and gravel. Limestone bedrock was encountered in one boring at 12 to 15 feet bgs and auger refusal occurred at 10 to 12 feet bgs in the remaining borings (Resource International, 2005).

Ground water occurs in the unconsolidated glacial deposits and the underlying bedrock. The limestone bedrock comprises the principal aquifer in the area although some wells may be completed in the overlying sand and gravel.

Ground water was encountered at depths of seven to 15 feet bgs in the 1982 borings or at the approximate level of the Olentangy River (Mason, Sandover and deVertiull, 1982). During the state site assessment field investigation in December 2006, depth to ground water in the open Geoprobe® boreholes was observed at 1.2 to 10 feet bgs upon completion of the borings. Ground water flow direction in the sand and gravel deposits at the site is anticipated to be toward the Olentangy River and has been observed discharging from fissures in the limestone along the west river bank during times of low river flow. Ground water flow direction at depth in the limestone may vary from the shallow ground water flow direction.

## **2.8 Land Use and Demographic Information**

The landfill is located on city-owned property within the city of Delaware in central Delaware County. According to 2000 census data, the population was 28,348 within a four mile radius of the site. The city's web site indicates the city's current population at

over 33,000. Land use and demographic information from Ohio EPA's geographic information system database is included in **Appendix A**.

In addition to the landfill, the city-owned land is also occupied by various municipal operations including the wastewater treatment plant, maintenance garage and salt sheds and recycling center. Land use surrounding the landfill is a mixture of residential, commercial, industrial, and agricultural and undeveloped usage. Land to the east and south of the landfill on the opposite side of the Olentangy River is primarily residential, agricultural and undeveloped land. Ohio Wesleyan University athletic fields are located west of U.S. Route 23 and the landfill. Commercial, industrial and residential land is located west of the athletic fields. Land use to the north of the landfill and wastewater treatment plant is residential and commercial. Another closed landfill operated by the city of Delaware from approximately 1974 to 1990, the Delaware Landfill, DERR ID # 121-000222, U.S. EPA ID # OHD000721357, is located at 991 Curve Road approximately 3700 east of the Olentangy River.

The city of Delaware provides municipal water service to its residents. Unincorporated areas to the east of the Olentangy River across from the landfill are in the city service area but are not presently served by municipal water and rely on private wells. A search of located water well logs from the Ohio Department of Natural Resources, Division of Water on-line database found 30 water well logs within a one mile radius of the landfill. These well logs indicate 26 wells are screened in the limestone bedrock and four are screened in the overlying sand and gravel. Five of the 30 water well logs were identified within a 1000 feet radius of the approximate landfill boundary. These five wells were reported as being screened in the limestone bedrock aquifer. It has not been verified if all the reported wells are still in service or if there are additional wells in the search radius that are not included in the database. The well logs are included in **Appendix B**.

The Olentangy River is a state-designated scenic river from the Delaware Lake dam downstream to Wilson Bridge Road in Worthington.

The Olentangy River is impounded approximately seven miles upstream of the landfill and forms Delaware Lake, a flood control and recreational reservoir. Immediately downstream of the reservoir is an active surface water intake that supplies the city of Delaware. This intake is located 3.5 mile upstream of the site, and supplies water to 28,000 people.

A second surface water intake is located approximately six and a half miles downstream from the landfill. This intake is owned by the Del-Co water utility and serves 29,928 people.

### 3.0. METHODS

Surface water, sediment and leachate samples were collected during the SESI sampling event. Samples were analyzed by approved U.S. EPA Contract Laboratory Program (CLP) laboratories. CLP analyses included the following TAL/TCL parameters: VOCs, SVOCs, pesticides, PCBs, TAL metals and cyanide. In addition to the CLP parameters, the surface water and leachate samples were analyzed for general water quality parameters and nutrients including chlorides, ammonia, sulfate, total dissolved solids (TDS), 5-day biochemical oxygen demand (BOD<sub>5</sub>), COD, TKN, phosphorus, nitrate/nitrite and hardness by Kemron Environmental Services, Inc., Ohio EPA's contract laboratory.

#### 3.1 Sampling Locations

Sample locations are displayed on **Figure 4** and are described below. Site location photographs are included in **Appendix C**.

##### ***Surface Water***

A total of ten surface water samples, designated with an SW prefix, were collected from the Olentangy River including background and duplicate samples. Nine surface water samples, SW-01 through SW-09, were collected from the Olentangy River, which borders the eastern boundary of the site. Sample SW-10 was collected from a 24-inch diameter storm sewer outfall. The surface water samples were collected on July 10, 2007.

SW-01 was the farthest downstream sample and was collected at the Olentangy Avenue bridge south (downstream) of the site. SW-02 was collected at the south end of the site from a ground water discharge area in the river. The discharge area was in a shallow area of the river and was identified by the visible upwelling it formed on the river surface and confirmed by differences in pH, specific conductance and temperature readings taken at the upwelling as opposed to locations in the river approximately ten feet away from the upwelling. SW-03 was collected in the vicinity of an area of the bank at the south end of the landfill containing reeds that is seasonally wet. SW-04 and a duplicate sample, SW-05, were collected immediately downstream from a 24-inch diameter storm sewer outfall. SW-06 was collected downstream from the mouth of Mill Run, a tributary entering from the east across from the landfill. SW-07 was collected downstream from the wastewater treatment plant outfall and near the north end of the landfill and upstream from most but not all of the landfill. SW-08 and SW-09 were collected as background samples in the river upstream of the landfill and wastewater treatment plant. SW-10 was collected from the 24-inch diameter storm sewer outfall discharge to the river.

##### ***Sediment***

Nine sediment samples, designated SE-01 through SE-09, were collected from the Olentangy River, including background and duplicate samples. The sediment samples were collected in the same general locations as the corresponding surface water samples except no sediment sample was collected in the vicinity of SW-10, the storm

sewer outfall sampling location. The sediment samples were collected on July 10, 2007.

### **Leachate**

Two samples, designated with an LS prefix, were collected from potential leachate seeps. LS-01 was collected from a flowing bedrock seep on the west bank of the Olentangy River at the far south end of the site on July 10, 2007. LS-02 was collected from standing water in a ditch believed to be attributable to landfill seepage in the vicinity of the city salt sheds on September 19, 2007.

## **3.2 Sampling Methods**

Standard quality assurance and quality control procedures for ESI field activities were followed during the investigation. Procedures for sample collection, packaging and shipping, and equipment decontamination, are documented in the *Quality Assurance Project Plan (QAPP), for Region 5 Superfund SI activities for Ohio EPA*, and the *Ohio EPA Field Standard Operating Procedures*.

### **Surface Water**

Surface water samples were collected by immersing the laboratory-supplied glassware beneath the water surface. Care was taken to allow the bottles to fill slowly and not wash out the sample preservative. At each surface water sampling location, field parameter measurements including pH, specific conductance and temperature were measured with a field meter and recorded.

### **Sediment**

Sediment samples were collected using stainless clean steel trowels or spoons in the general vicinity of each corresponding surface water sample. The area around each surface water sample was probed to find sufficient sediment for laboratory analysis. The sediment was collected in stainless steel bowls and transferred by spoon into the laboratory-supplied glassware.

### **Leachate**

Leachate samples were collected by directly filling into the glassware (LS-01) or bottle immersion (LS-02). Temperature, pH and specific conductance measurements were measured with a field meter and recorded.



#### 4.0. RESULTS

Surface water and sediment samples were compared to background sample locations SW-08/SE-08 and SW-09/SE-09, which were collected from the Olentangy River upstream from the landfill and the wastewater treatment plant outfall.

Under the Hazard Ranking System (HRS), results are considered significant if the concentrations are three times the background concentrations and above the Contract Required Detection Limit (CRDL) or Contract Required Quantitation Limit (CRQL). The data were reviewed by U.S. EPA Region 5 personnel for compliance with the Contract Laboratory Program, and electronically validated by using the U.S. EPA Computer-Aided Data Review and Evaluation software program.

For purposes of site scoring, sample results for CLP analytes for surface water, sediment and leachate samples that yielded detections with concentrations greater than three times the highest concentration of the two background samples and greater than the specified CRDL or CRQL were considered significant detections. Significant surface water and leachate detections are included in **Table 1**. Significant sediment detections are included in **Table 2**. Complete sample results for the CLP analytes are included in **Appendix D**.

Surface water and leachate samples analyzed for non-CLP nutrient and general water quality analytes are noted below if the sample result concentrations are greater than three times the highest background concentration. These analytes have no CRDL or CRQL. The non-CLP results are included in **Appendix E**.

Soil, ground water and leachate sample results from Ohio EPA's state site assessment are included in **Appendix F**.

##### **Surface Water**

VOCs detected at low concentrations included trichloroethylene in SW-02, the in-stream seep sample, and methylene chloride in SW-03 and SW-04. SVOCs, butylbenzyl phthalate and BEHP, were detected in all samples (including background). Atrazine was detected at low concentrations in all samples except SW-02 and SW-10, the storm sewer outfall sample. Pesticides and metals were detected in all samples.

Significant detections, CLP analyte detections at least three times higher than the highest of the two background samples and greater than the CRQL or CRDL, were reported from one surface water sample, SW-10, the storm sewer outfall sample. However, there were no significant detections in the samples collected from the Olentangy River. The SW-10 significant detections consisted of metals including barium, mercury, iron, potassium and sodium.

Two of the significant metal detections in SW-10 also exceed state surface water standards as well. Barium, detected at 1700 ug/L, exceeded the aquatic life outside mixing zone average (OMZA) standard of 220 ug/L and mercury, detected at 0.97 ug/L,

exceeds the OMZA and human health non-drinking water standards of 0.91 ug/L and 0.012 ug/L, respectively.

Nutrient and general water quality parameters were detected in several water samples at elevated concentrations particularly at the SW-10 storm sewer outfall sample, which had detections of ammonia at 54.3 mg/L, TKN at 50.2 mg/L, COD at 69.9 mg/L and chlorides at 2970 mg/L. Sample SW-02 had a chloride concentration of 154 mg/L and sulfate at 324 mg/L. Field measurements of pH indicated a drop in pH downstream of the landfill.

Table 1 – Surface Water and Leachate Sample Significant Detections

Sample Number :	ME1783		ME1888		ME1855		ME1853		ME1854	
Sampling Location :	LS-01		LS-02		SW-10		SW-08		SW-09	
Description:	Leachate		Leachate		Outfall		Upgradient 1		Upgradient 2	
Units :	ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :	7/10/2007		9/19/2007		7/10/2007		7/10/2007		7/10/2007	
Time Sampled :			12:20							
Dilution Factor :	1.0		1.0		1.0		1.0		1.0	
ANALYTE	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALUMINUM			4720	J			1040		1070	
ARSENIC			17.1	J+			10.0	U	10.0	U
BARIUM			584		1700		63.7	J	62.2	J
CALCIUM	206000		236000		208000		51800		52700	
CHROMIUM			18.5	J			1.2	J	1.5	J
COPPER			47.5	J+			3.0	UJ	4.0	UJ
IRON	4610		8210	J	5750		1000		1090	
MAGNESIUM					85500		20700		20500	
MERCURY					0.97		0.11	J	0.20	U
LEAD			19.9	J			10.0	UJ	10.0	UJ
POTASSIUM			13000		70700	J	4030	J	4020	J
SILVER							10.0	U	10.0	U
SODIUM			6040000		1310000	J	19800	J	20200	J
ZINC			130	J			13.2	UJ	22.3	UJ
CYANIDE			16.2				10.0	U	10.0	U

J – The value is estimated

U – The compound was undetected

### Sediment

Acetone, methylene chloride and 2-butanone were detected in several of the sediment samples; however, these analytes are common laboratory contaminants. Carbon disulfide was also found in low concentrations in several sediment samples but it may be naturally occurring. SVOCs detected in the sediment samples include numerous polynuclear aromatic hydrocarbons (PAHs, naphthalene, BEHP, and phenol. PCBs (Arochlor 1254) and several pesticides were also detected in the sediment samples. Metals were detected in all sediment samples.

Significant detections included acetone in SE-04; SVOCs in SE-01, SE-02, SE-05 and SE-07, including several PAHs in SE-01, SE-05 and SE-07; and pesticides in SE-01, SE-05 and SE-06. Significant metals detections included mercury in SE-04 and sodium in SE-04 and SE-05.

It should be noted that SE-04 contained no significant detections of pesticides or SVOCs, however, its duplicate sample, SE-05, contained several significant pesticide and SVOC detections including numerous PAHs. Additionally, SE-07 contains numerous PAH detections in similar concentrations to, and provides a better match to, SE-05 suggesting a potential laboratory or field error. However, reviews of field procedures by Ohio EPA and laboratory quality assurance by U.S. EPA Region 5 could not determine a possible error that would invalidate the data for these samples.

Table 2 – Sediment Sample Significant Detections

Sample Number :	E1790	E1791	E1792	E1793	E1794	E1795	E1796	E1797	E1798
Sampling Location :	SE-01	SE-02	SE-03	SE-04	SE-05	SE-06	SE-07	SE-08	SE-09
Description :	Downstream of site	South end of site	Vicinity of cattail seep	River at storm outfall	Dup. of SE-04	Downstream of Mill Run	Downstream of WWTP	Upgradient 1	Upgradient 2
Units :	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Date Sampled :	7/10/2007	7/10/2007	7/10/2007	7/10/2007	7/10/2007	7/10/2007	7/10/2007	7/10/2007	7/10/2007
Time Sampled :									
%Moisture :	34	50	46	34	48	56	33	30	40
Dilution Factor :	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volatile Compound									
Acetone				24				4.3 J	16 U
Semi-volatile Compound									
Acenaphthylene					250 J			240 U	8.5 J
Acenaphthene							190 J	11 J	22 J
Dibenzofuran					220 J			10 J	14 J
Fluorene					460 J		240 J	17 J	34 J
Phenanthrene					2600		1300	180 J	430
Anthracene					580		460	48 J	73 J
Fluoranthene					2900		2300	500	740
Pyrene					2900		2200	390	610
Benzo(a)anthracene	1100				1400		1300	230 J	260 J
Chrysene	800				1400		1000	230 J	260 J
Bis(2-ethylhexyl)phthalate		310 J			660			44 J	52 J
Benzo(b)fluoranthene	1500				2000		1600	330	430
Benzo(k)fluoranthene	480				620		480	110 J	130 J
Benzo(a)pyrene	910				1300		1100	210 J	250 J
Indeno(1,2,3-cd)pyrene	440 J				830 J		570 J	120 J	140 J
Benzo(g,h,i)perylene	370 J				710 J		460 J	97 J	120 J
Pesticide Compound									
4,4'-DDE						3.6 J		4.7 U	5.5 U
4,4'-DDT	3.7 J				6.1 J			4.7 U	5.5 U
Endrin aldehyde					3.5 J			4.7 U	5.5 U
alpha-Chlordane					4.1 J	1.8 J		2.4 U	2.9 U
gamma-Chlordane					7.6			2.4 U	0.7 J
PCB Compound									
Aroclor-1254	74 J				120 J	89		23 J	23 J
Inorganic Analyte									
MERCURY				0.10 J				0.15 U	0.14 U
SODIUM				480 J	564 J			125 J	137 J

J – The value is estimated

U – The compound was undetected

***Leachate***

Sample LS-01 collected from the river bank seep on July 10, 2007, yielded detections of two SVOCs, BEHP and butylbenzyl phthalate; one pesticide, heptachlor; and metals. Sample LS-02, collected September 19, 2007, yielded detections of 2-butanone, two pesticides, metals and cyanide.

Significant detections for LS-01 included calcium and iron. Significant detections in SW-02 included aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, potassium, silver, sodium, zinc and cyanide.

Two of the significant detections in LS-02 also exceeded state surface water standards including barium detected at 584 ug/L and cyanide detected at 16.2 ug/L, which have aquatic life standards of 220 ug/L and 12 ug/L, respectively.

Elevated nutrient and general water quality parameters at LS-01 included ammonia at 1.02 mg/L, chloride at 162 mg/L and sulfate at 386 mg/L. Elevated nutrient and general water quality parameters at LS-02 included ammonia at 0.624 mg/L, TKN at 4.91 mg/L, chloride at 9840 mg/L, sulfate at 493 mg/L, phosphorus at 1.35 mg/L and COD at 901 mg/L.



## 5.0 DISCUSSION

### 5.1 Migration and Exposure Pathways

#### ***Surface Water Pathway***

Surface water samples were collected from the Olentangy River on July 10, 2007. Samples collected upstream from, adjacent to and downstream from the landfill were analyzed for CLP TAL/TCL parameters as well as nutrient and general water quality parameters. There were no significant detections noted in the surface water samples collected from the Olentangy River.

The 24-inch diameter storm sewer outfall discharge (SW-10) was also sampled as part of the SESI sampling event on July 10, 2007. Notable detections at this sampling location included barium, mercury and sodium as well as elevated ammonia, TKN, COD and chlorides. These detections indicate infiltration of landfill leachate into the storm sewer as well as contributions of elevated chloride and sodium from the city's salt and brine handling operations.

Surface water is not used as a potable water supply in the vicinity of the landfill; however, the Del-Co water utility has two surface water intakes approximately six and a half miles downstream. The river is a designated state scenic river adjacent to the landfill and is used for recreational purposes such as canoeing and fishing.

Sediment samples collected from locations downstream from the landfill contained concentrations of PAHs, pesticides, metals and PCBs, which were elevated relative to background. The source of these detections above background concentrations may be partly or wholly attributable to the landfill. The streambed consists primarily of bedrock and coarser grained deposits such as sand and gravel but some fine grained deposits that are more likely to harbor these contaminants are present and may also be transported downstream during higher water conditions. Exposure potentially occurs to recreational users of the river including fishermen, canoers and waders.

#### ***Soil Exposure Pathway***

VOCs, SVOCs, metals, and PCBs were detected in site soils during the state site assessment. Soil exposure through direct contact at the site is not expected to be significant provided the soil cover on the landfill is adequately maintained. However, exposure could be a concern if erosion occurs or if excavation activities associated with construction or utility repair occur in the waste area. Runoff from precipitation and flooding from the river may also provide a transport mechanism to the river.

Access to the site is only partially restricted by fencing and is achieved from the city maintenance garage complex or by the recycling center. Access from the river is not controlled and the landfill may be accessed by recreational users such as canoers and fishermen.

**Ground Water Pathway**

Ground water samples collected as part of the state site assessment yielded exceedances of MCLs by vinyl chloride, benzene, BEHP and arsenic. The ground water also contains elevated detections of ammonia and other nutrients. Ground water discharge is anticipated to be toward the Olentangy River. Shallow ground water at the site is not used for potable purposes, although non-potable exposure pathways such as indoor vapor intrusion may potentially be complete especially if the site is developed in the future.

Shallow ground water occurs in the unconsolidated deposits and the uppermost part of the underlying limestone at the landfill and is anticipated to discharge to the Olentangy River. Areas of seepage were observed along the west river bank especially south of the city recycling center where orange-stained ground water was observed discharging from the limestone bedrock to the river.

Thirty residential well logs were located within a four mile radius of the site. It is unknown how many of these wells are still in service. Five supply well logs are finished in the unconsolidated sand and gravel deposits. Three of these five well logs are for locations in the city of Delaware, north, west or southwest of the landfill and two are located to the southeast in upland areas on the east side of the Olentangy River. The remainder of the wells are completed in the limestone bedrock at varying depths primarily in the city of Delaware. No well logs were found for the city-owned property on which the landfill is located.

It should be noted that ground water within the underlying limestone bedrock was not accessible with the Geoprobe® rig and was not characterized as part of the state site assessment. Ground water in the uppermost bedrock at the site likely discharges to the Olentangy River as has been observed in bedrock seeps along the river bank although recharge to deeper bedrock with a different flow direction could occur if there is a significant downward vertical hydraulic gradient at the site.

**Air Pathway**

The site is mostly vegetated. The air exposure pathway is not considered to be significant; however, disturbing soil could release dust-borne contaminants locally. As long as adequate soil and vegetative cover is maintained on the former landfill, exposure to airborne or dust-borne contaminants should be not be significant.

Explosive gas migration monitoring is conducted at the site through a series of explosive gas monitoring wells, which are sampled periodically. The results of the monitoring are reported to Ohio EPA DSIWM. The buildings on site are equipped with explosive gas monitoring alarms.

**Ecological Targets**

The Olentangy River is a designated state scenic river from Delaware Dam south to Wilson Bridge Road in Worthington and is classified as an outstanding state water



based on exceptional ecological values in the same stretch. The river in the vicinity of the landfill is categorized as warm water habitat. Leachate and contaminated ground water entering the river from the landfill could locally affect the biota especially during times of low river flow particularly if effluent from the wastewater treatment plant is not at its optimum quality.

The Olentangy River from Claridon to the Scioto River is currently under a Waterbody Specific Advisory. Although the advisory is not specific to the site, it includes the portion of the river that borders the site. The advisory recommends limiting the consumption of one smallmouth bass per month 12" and over. The specific contaminant of concern is mercury.

## **6.0. CONCLUSIONS**

The Old Delaware City Landfill has a history of leachate outbreaks discharging to the Olentangy River. Results of a state site assessment field investigation also confirmed contamination in shallow ground water, which is anticipated to discharge to the river. While sampling of the Olentangy River did not yield significant detections in surface water, some PAHs, pesticides, PCBs and metals that were detected in sediment above background concentrations may be attributable to the landfill.



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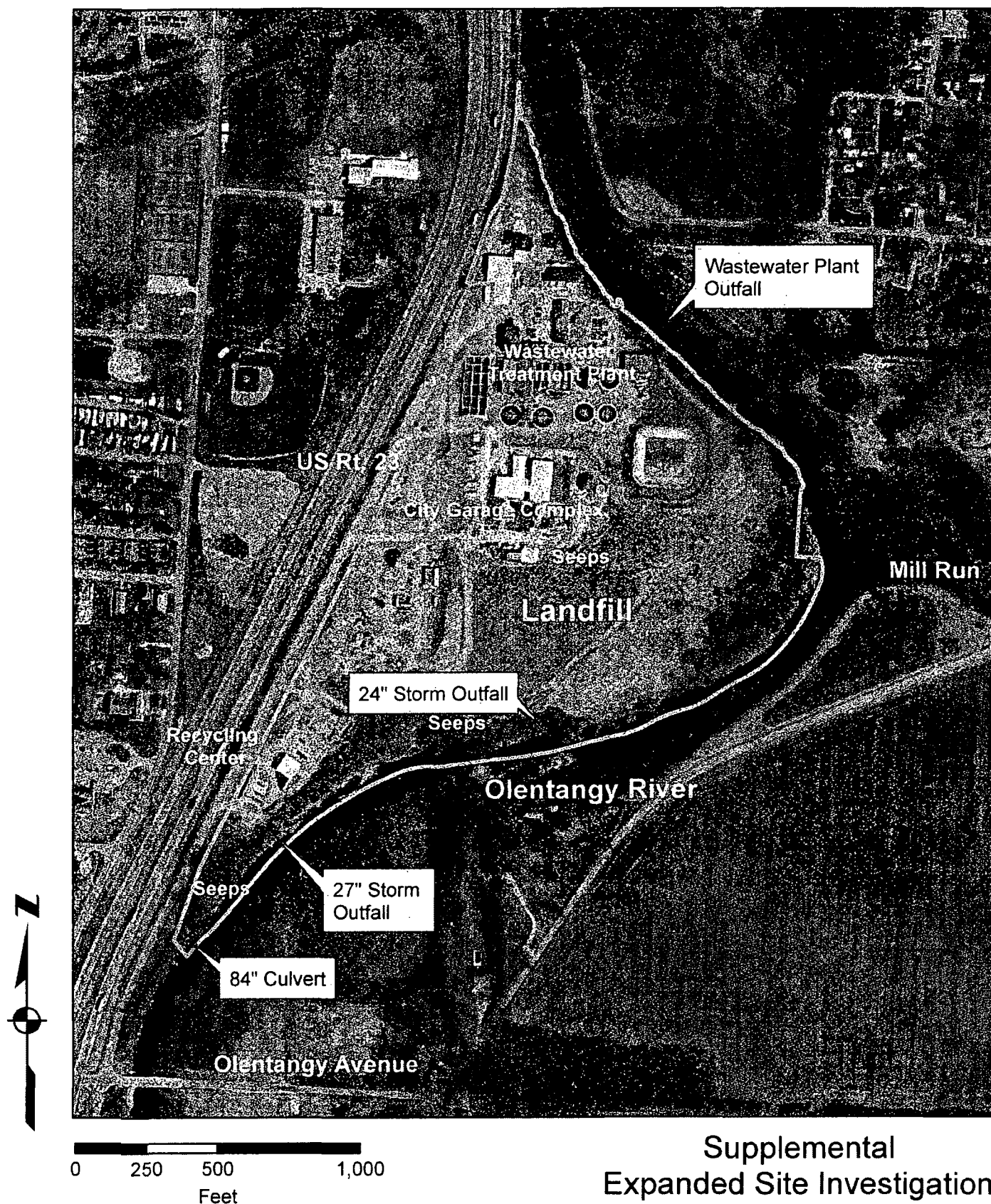
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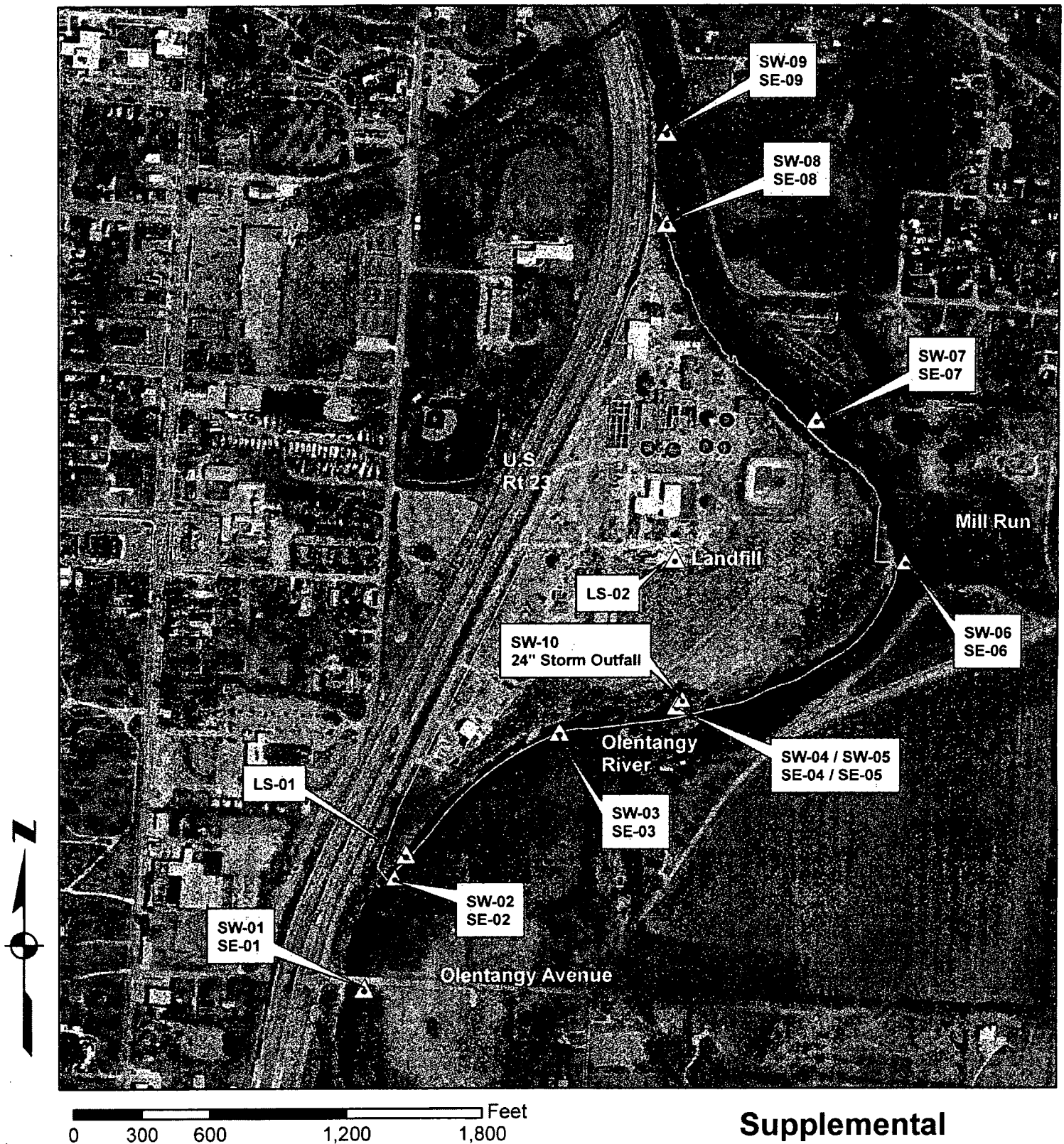
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DRAFT



Supplemental  
Expanded Site Investigation  
Old Delaware City Landfill  
Site Features

Figure 2



**Supplemental  
Expanded Site Investigation  
Old Delaware City Landfill  
Sample Location Map**

Surface water (SW) and sediment samples (SE) collected on 7/10/07.  
Leachate samples LS-01 collected on 7/10/07 and LS-02 on 9/19/07.

**Figure 4**